(11)Publication number : 2002-311413
(43)Date of publication of application : 23.10.2002

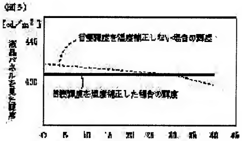
(51)Int.Cl. G02F 1/133
G02F 1/13357
G09G 3/20
G09G 3/34
G09G 3/36

(21)Application number : 2001-119318
(22)Date of filing : 18.04.2001

(71)Applicant : TOTOKU ELECTRIC CO LTD
(72)Inventor : OKAMURA HIDETO

(54) LUMINANCE CONTROL METHOD FOR LIQUID CRYSTAL DISPLAY DEVICE, LUMINANCE CONTROL DEVICE AND LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To keep the luminance of a liquid crystal display device constant even if the temperature is fluctuated.
SOLUTION: Stored target luminance is temperature compensated, the luminance of a backlight is controlled by the temperature compensated target luminance and the fluctuation of the light transmission ratio of a liquid crystal panel by temperature is compensated. Thus, the luminance of the liquid crystal display device is maintained to a level of the target luminance set by a user, regardless of temperature fluctuation.



CLAIMS

[Claim(s)]
[Claim 1]An intensity control method of a liquid crystal display carrying out correction for temperature of the target luminance based on temperature in a device in an intensity control

method of a liquid crystal display which controls luminosity of a back light so that luminosity of a back light is measured and luminosity of a back light is substantially in agreement with target luminance.

[Claim 2]Until luminosity of a back light reaches target luminance substantially from powering on, Measure luminosity of a back light for every control interval [the], and if luminosity of a back light is lower than target luminance the 1st more than permissible dose, only the 1st unit quantity will make luminosity of a back light increase, If luminosity of a back light is higher than target luminance the 1st more than permissible dose, after only the 1st unit quantity will decrease luminosity of a back light and luminosity of a back light will reach a desired value substantially, Luminosity of a back light is measured every 2nd control interval longer than said 1st control interval, An intensity control method of a liquid crystal display if only the 2nd unit quantity will make luminosity of a back light increase if luminosity of a back light is lower than a target the 2nd more than permissible dose, and luminosity of a back light is higher than a desired value the 2nd more than permissible dose, wherein only the 2nd unit quantity will decrease luminosity of a back light.

[Claim 3]An intensity control device of a liquid crystal display characterized by comprising the following.

A measurement-of-luminance means to measure luminosity of a back light.

A brilliance-control means to adjust luminosity of a back light so that luminosity of a back light may be substantially in agreement with target luminance.

A temperature measurement means which measures temperature in a device.

A target luminance setting-out means for setting up target luminance of a back light, and a target luminance compensation means which carries out correction for temperature of the target luminance based on temperature in a device.

[Claim 4]An intensity control device of a liquid crystal display characterized by comprising the following.

Until luminosity of a back light reaches target luminance substantially from powering on, Measure luminosity of a back light for every control interval [the], and if luminosity of a back light is lower than target luminance the 1st more than permissible dose, only the 1st unit quantity will make luminosity of a back light increase, A 1st brilliance-control means by which only the 1st unit quantity will decrease luminosity of a back light if luminosity of a back light is higher than target luminance the 1st more than permissible dose.

After luminosity of a back light reaches target luminance substantially, Measure luminosity of a back light every 2nd control interval longer than said 1st control interval, and if luminosity of a back light is lower than target luminance the 2nd more than permissible dose, only the 2nd unit quantity will make luminosity of a back light increase, A 2nd brilliance-control means by which only the 2nd unit quantity will decrease luminosity of a back light if luminosity of a back light is higher than target luminance the 2nd more than permissible dose.

[Claim 5]A liquid crystal display comprising:

A liquid crystal panel.

A back light.

The intensity control device according to claim 3.

[Claim 6]A liquid crystal display comprising:

A liquid crystal panel.

A back light.

The intensity control device according to claim 4.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention about the intensity control method of a liquid crystal display, an intensity control device, and a liquid crystal display in more detail, Even if the characteristic of the intensity control method of a liquid crystal display, a device, and a back light that the luminosity of a liquid crystal display is uniformly maintainable even if it changes temperature has variation, it is related with the intensity control method of a liquid crystal display and device which can fully improve the standup of screen intensity.
[0002]
[Description of the Prior Art]- In the 1st conventional technology-JP,10-222084,A and JP,10-222129,A. A photosensor detects the light which leaked to the back of a back light, the present backlight luminance is measured, and the art of adjusting the electric power supplied to a back light is indicated so that this present backlight luminance may be in agreement with a user luminosity preset value. So that the light which enters into a liquid crystal panel may be detected from a back light by a photo detector in JP,11-295691,A, the present backlight luminance may be measured and this present backlight luminance may be in agreement with a user luminosity preset value, The art of adjusting the electric power supplied to a back light is indicated.
[0003]- Larger electric power than the electric power corresponding to set luminance is supplied to a back light before specified time elapse from powering on, and the art which makes power supply small gradually to the electric power corresponding to set luminance is indicated after specified time elapse by the 2nd conventional technology-JP,7-13128,A.
[0004]
[Problem(s) to be Solved by the Invention]It is controlling by the 1st conventional technology of the above so that the luminosity of a back light becomes fixed. However, since the light transmission efficiency of a liquid crystal panel changes with temperature even when the luminosity of a back light is constant, the luminosity as a liquid crystal display has a problem changed with temperature.
[0005]In the 2nd conventional technology of the above, the standup of screen intensity is improved by making electric power from powering on to predetermined time larger than usual. However, in the back light control based on the lapsed time from a power up, although the standup of screen intensity can improve, there is a problem of changing screen intensity in connection with lapsed time.
[0006]Then, the 1st purpose of this invention is to provide the intensity control method of a liquid crystal display that the luminosity of a liquid crystal display is uniformly maintainable, a device, and a liquid crystal display, even if it changes temperature. The 2nd purpose of this invention improves the standup of the luminosity of the liquid crystal display from a power up, and there is in providing the intensity control method of a liquid crystal display that a screen intensity value is uniformly maintainable at an early stage, a device, and a liquid crystal display.
[0007]
[Means for Solving the Problem]In an intensity control method of a liquid crystal display which controls luminosity of a back light by the 1st viewpoint so that this invention measures

luminosity of a back light and luminosity of a back light is substantially in agreement with target luminance, An intensity control method of a liquid crystal display carrying out correction for temperature of the target luminance based on temperature in a device is provided. Since luminosity of a back light will also be uniformly controlled irrespective of temperature if target luminance is fixed irrespective of temperature, change of light transmission efficiency of a liquid crystal panel by temperature will turn into change of luminosity as a liquid crystal display as it is. Then, according to temperature, target luminance is changed so that change of light transmission efficiency of a liquid crystal panel by temperature may be compensated with an intensity control method of a liquid crystal display by the 1st viewpoint of the above. Of course, target luminance is coincided with target luminance at the time of setting out when there is no difference of temperature and current temperature at the time of target luminance setting out. Since it is controlled so that luminosity of a back light also changes with temperature since target luminance changes with temperature, but it is what compensates change of light transmission efficiency of a liquid crystal panel by temperature, luminosity as a liquid crystal display will be maintained by luminosity when target luminance is set up. When "it is substantially in agreement" is thoroughly in agreement and does not have a difference in the above-mentioned composition, it is not thoroughly in agreement and there is a difference, but a case where it is a grade which cannot recognize the difference visually is meant. [it] [it]

[0008]In the 2nd viewpoint, this invention until luminosity of a back light reaches target luminance substantially from powering on, Measure luminosity of a back light for every control interval [the], and if luminosity of a back light is lower than target luminance the 1st more than permissible dose, only the 1st unit quantity will make luminosity of a back light increase, If luminosity of a back light is higher than target luminance the 1st more than permissible dose, after only the 1st unit quantity will decrease luminosity of a back light and luminosity of a back light will reach a desired value substantially, Luminosity of a back light is measured every 2nd control interval longer than said 1st control interval, If luminosity of a back light is lower than a target the 2nd more than permissible dose, only the 2nd unit quantity will make luminosity of a back light increase, and if luminosity of a back light is higher than a desired value the 2nd more than permissible dose, an intensity control method of a liquid crystal display that only the 2nd unit quantity is characterized by decreasing luminosity of a back light is provided. You make it fluctuate the 1st unit quantity of luminosity of a back light at a time with the 1st comparatively short control interval in an intensity control method of a liquid crystal display by the 2nd viewpoint of the above immediately after powering on. For this reason, a luminance value of a back light reaches target luminance promptly. And since it controls measuring luminosity of a actual back light, even if the characteristic of a back light has variation, a standup of screen intensity is improvable enough. Since you make it fluctuate the 2nd unit quantity of luminosity of a back light at a time with the 2nd comparatively long control interval after luminosity of a back light reaches target luminance, starting of a back light can be stabilized. If it is the 1st control interval = 2nd control interval, a standup of screen intensity becomes late, or change of screen intensity will come to be recognized visually, and it is not desirable.

[0009]An intensity control device of a liquid crystal display this invention is characterized by that comprises the following in the 3rd viewpoint.

A measurement-of-luminance means to measure luminosity of a back light.

A brilliance-control means to adjust luminosity of a back light so that luminosity of a back light may be substantially in agreement with target luminance.

A temperature measurement means which measures temperature in a device.

A target luminance setting-out means for setting up target luminance of a back light, and a target luminance compensation means which carries out correction for temperature of the target luminance based on temperature in a device.

In an intensity control device of a liquid crystal display by the 3rd viewpoint of the above, an intensity control method of a liquid crystal display by said 1st viewpoint can be enforced suitably.

[0010]An intensity control device of a liquid crystal display this invention is characterized by that comprises the following in the 4th viewpoint.

Until luminosity of a back light reaches target luminance substantially from powering on, Measure luminosity of a back light for every control interval [the], and if luminosity of a back light is lower than target luminance the 1st more than permissible dose, only the 1st unit quantity will make luminosity of a back light increase, A 1st brilliance-control means by which only the 1st unit quantity will decrease luminosity of a back light if luminosity of a back light is higher than target luminance the 1st more than permissible dose.
After luminosity of a back light reaches target luminance substantially, Measure luminosity of a back light every 2nd control interval longer than said 1st control interval, and if luminosity of a back light is lower than target luminance the 2nd more than permissible dose, only the 2nd unit quantity will make luminosity of a back light increase, A 2nd brilliance-control means by which only the 2nd unit quantity will decrease luminosity of a back light if luminosity of a back light is higher than target luminance the 2nd more than permissible dose.
In an intensity control device of a liquid crystal display by the 4th viewpoint of the above, an intensity control method of a liquid crystal display by said 2nd viewpoint can be enforced suitably.
[0011]A liquid crystal display this invention is characterized by that comprises the following in the 5th viewpoint.
Liquid crystal panel.
Back light.
An intensity control device of claim 3.
In a liquid crystal display by the 5th viewpoint of the above, an intensity control method of a liquid crystal display by said 1st viewpoint can be enforced suitably. A liquid crystal display this invention is characterized by that comprises the following in the 6th viewpoint.
Liquid crystal panel.
Back light.
An intensity control device of claim 4.
In a liquid crystal display by the 6th viewpoint of the above, an intensity control method of a liquid crystal display by said 2nd viewpoint can be enforced suitably.
[0012]
[Embodiment of the Invention]Hereafter, the embodiment shown in a figure explains this invention still in detail. Thereby, this invention is not limited.
[0013]Drawing 1 is a block diagram showing the composition of the liquid crystal display concerning one embodiment of this invention. This liquid crystal display 100 is provided with the following.
Liquid crystal panel 1.
Back light 2.
The luminance sensor 3 for measuring the luminosity of the back light 2.
The temperature sensor 4 for measuring the temperature of the liquid crystal panel 1, and the manual operation button 5 for a user to operate target luminance setting out of the back light 2, etc., The drive control circuit 7 which performs target luminance setting processing, backlight luminance control management, etc. concerning the driving processing and this invention of the liquid crystal panel 1 based on the data from the electric power switch 6 for turning on and off the power supply of the liquid crystal display 100, and upper devices, such as a personal computer.

[0014]Drawing 2 is an important section sectional view of the liquid crystal display 100. The back light 2 is installed in the back of the liquid crystal panel 1, and both are unified by the LCD panel cover 11. The light-receiving mouth 11a is drilled by the back of the LCD panel cover 11, and the light of the back light 2 leaks to the back.
[0015]The back cover 12 is unified so that the LCD panel cover 11 may be covered. The luminance sensor 3 is attached to the position which can receive the light of the back light 2 which leaks from the light-receiving mouth 11a in the back cover 12, and the temperature sensor 4 is attached to the position which can detect further the temperature of the building envelope formed between the LCD panel covers 11.

[0016]The circuit board covering 13 is attached to the back of the back cover 12, and is supporting the circuit board 14. The drive control circuit 7 is carried on the circuit board 14.
[0017]Drawing 3 is a flow chart showing the target luminance setting processing by the liquid crystal display 100. This target luminance setting processing is started, when a user uses a manual operation button and performs setting operation of target luminance, while the electric power switch 6 was made one. In Step K1, the temperature (tc) in a device is measured with the temperature sensor 4. The luminosity (XC) of the back light 2 is measured with the luminance sensor 3. in Step K2, correction for temperature was carried out using the temperature (tc) in a device -- it target-luminance-(X)-computes and memorizes. The correction for temperature at this time is an operation contrary to the correction for temperature in Step S3 mentioned later, and explanation of Step S3 describes it for details.
[0018]Drawing 4 is a flow chart showing the backlight luminance control management by the liquid crystal display 100. This backlight luminance control management is started simultaneously with one of the electric power switch 6. In Step S1, the back light 2 is driven for 3 seconds with minimum luminance (until the liquid crystal display 100 operates stably). In Step S2, the temperature (to) in the liquid crystal display 100 and the luminosity (X0) of the back light 2 are measured. In Step S3, correction for temperature of the memorized target luminance value (X) is carried out, and the luminosity desired value (Xto) which carried out correction for temperature is computed. This correction for temperature puts the liquid crystal display 100 into a thermostat, and changes temperature, The luminosity of the back light 2 is adjusted so that the luminosity of the liquid crystal panel 1 may be kept constant, A luminosity desired value (Xto) is calculated for the temperature characteristics of the luminosity of the back light 2 from mathematization or target luminance value (X) which was table-ized and had been memorized using the temperature characteristics, its temperature, and current temperature (to). For example, when making (X) into the target luminance at 30 **, correction for temperature is performed by the following formula.
(Xto) =alpha and (to-30) +(X) 0 **<=to<30 ** =(Xto) beta and (to-30) +(X) 30 **<=to -- <, if 40 ** of upper types are transformed, =(Xto)- (X) -- alpha and (to-30) 0 **<=to -- < -- it becomes 30 ** (X)=(Xto)-beta and (to-30) 30 **<=to<40 **. Therefore, the time of setting to (XC) target luminance set up at temperature (tc), it becomes (X)=(Xtc)-alpha and (tc-30) 0 **<=tc<30 ** (X) =(Xtc)-beta and (tc-30) 30 **<=tc<40 **, and the temperature correction formula in said step K2 is obtained. It is convenient to calculate, if the target luminance value of a breaking point is memorized when using the temperature correction formula expressed with the polygonal line which consists of two straight lines. In step S4, the electric power which supplies only the output equivalent to the difference (Xd) of the target temperature (Xto) which carried out correction for temperature, and the measured luminosity (X0) to the back light 2 is increased.
(Xd)=(Xto)-(X0)
[0019]For 0.5 second is stood by in Step S5. This standby time is equivalent to the 1st control interval. In Step S6, the temperature (t1) in the liquid crystal display 100 and the luminosity (X1) of the back light 2 are measured. In Step S7, correction for temperature of the memorized target luminance value (X) is carried out, and the luminosity desired value (Xt1) which carried out correction for temperature is computed. For example, it is =(Xt1) alpha and (t1-30) +(X) 0 **<=t1<30 ** =(Xt1) beta and (t1-30) +(X) 30 **<=t1<40 **. In Step S8, if luminosity (X1) is not less than the target luminance value (Xt1) [cd/m^2]**10, it will shift to step S9, and if it is less than, it shifts to Step S10. In step S9, if luminosity (X1) is larger than the target luminance value (Xt1) [cd/m^2]+1, the electric power which supplies only the output equivalent to 1 [cd/m^2] to the back light 2 will be reduced. If luminosity (X1) is smaller than target luminance value (Xt1)-1 [cd/m^2], the electric power which supplies only the output equivalent to 1 [cd/m^2] to the back light 2 will be increased. And it returns to said step S5.
[0020]For 3.0 seconds is stood by in Step S10. This standby time is equivalent to the 2nd control interval. In Step S11, the temperature (t2) in the liquid crystal display 100 is measured, correction for temperature of the memorized target luminance value (X) is carried out, and the luminosity desired value (Xt2) which carried out correction for temperature is computed. For

example, it is =(Xt2) alpha and (t2-30) +(X) 0 **<=t2<30 ** =(Xt2) beta and (t2-30) +(X) 30 **<=t2<40 **. In Step S12, the luminosity (X2) of the back light 2 is measured. In Step S13, if luminosity (X2) is not less than the target luminance value (Xt2) [cd/m^2]**20, it will return to said step S5, and if it is less than, it shifts to Step S14. In Step S14, if luminosity (X2) is less than the target luminance value (Xt2) [cd/m^2]**3, it returns to said step S10, and if it is not less than, it will shift to Step S15. In Step S15, if luminosity (X2) is larger than the target luminance value (Xt2) [cd/m^2]+1, the electric power which supplies only the output equivalent to 1 [cd/m^2] to the back light 2 will be reduced. If luminosity (X2) is smaller than target luminance value (Xt2)-1 [cd/m^2], the electric power which supplies only the output equivalent to 1 [cd/m^2] to the back light 2 will be increased. And it returns to said step S10.

[0021]Drawing 5 is a rising-characteristic figure of the luminosity of the screen of the liquid crystal panel 1. The "control OFF" of drawing 5 is a result at the time of omitting Step S5 of drawing 4 - S9, and S13 (it shifts to Step S10 from step S4, and shifts to Step S14 from Step S12). In this case, in order to perform a brilliance control only at intervals of 3 seconds, it takes time until it reaches target luminance substantially. That is, a target luminance value is not reached until the back light 2 carries out saturation (for about 30 minutes). The "control ON" of drawing 5 is a result at the time of performing all the steps of drawing 4. In this case, since a brilliance control is performed at intervals of 0.5 second at the time of a standup, time until it reaches target luminance substantially can be shortened. For example, a target luminance value is reached in 5 minutes.

[0022]Drawing 6 is a temperature profile of the luminosity of the screen of the liquid crystal panel 1. The dashed line of drawing 6 is a result when not carrying out correction for temperature of the target luminance (when Step S3 of drawing 4, S7, and S11 are omitted). In this case, the luminosity of the back light 2 is uniformly maintained with target luminance when a user sets up. For this reason, change of the light transmission efficiency of the liquid crystal panel 1 by temperature will appear as change of the luminosity as the liquid crystal display 100 as it is. The solid line of drawing 6 is a result at the time of carrying out correction for temperature of the target luminance (when all the steps of drawing 4 are performed). In this case, correction for temperature of the target luminance which the user set up is carried out so that change of the light transmission efficiency of the liquid crystal panel 1 by temperature may be compensated. For this reason, the luminosity as the liquid crystal display 100 is maintained irrespective of a temperature change by the luminosity corresponding to the target luminance which the user set up. .

[0023]In the above-mentioned liquid crystal display 100, the luminance sensor 3 and the drive control circuit 7 constitute a measurement-of-luminance means. The drive control circuit 7 constitutes a brilliance-control means. The temperature sensor 4 and the drive control circuit 7 constitute a temperature measurement means. The manual operation button 5 and the drive control circuit 7 constitute a target luminance setting-out means. The drive control circuit 7 constitutes a target luminance compensation means. The drive control circuit 7 constitutes the 1st brilliance-control means and the 2nd brilliance-control means.

[0024]

[Effect of the Invention]According to the intensity control method of a liquid crystal display, intensity control device, and liquid crystal display of this invention, the luminosity as a liquid crystal display is maintained irrespective of a temperature change by the luminosity corresponding to the target luminance which the user set up. Rise time until it reaches target luminance can be shortened.

[Translation done.]

DESCRIPTION OF DRAWINGS

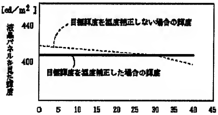
[Brief Description of the Drawings]
[Drawing 1]It is a configuration block figure of the liquid crystal display concerning one embodiment of this invention.
[Drawing 2]It is an important section sectional view of the liquid crystal display concerning one embodiment of this invention.
[Drawing 3]It is a flow chart of the target luminance setting processing concerning one embodiment of this invention.
[Drawing 4]It is a flow chart of the backlight luminance control management concerning one embodiment of this invention.
[Drawing 5]It is a rising-characteristic figure showing the effect of this invention.
[Drawing 6]It is a temperature profile showing the effect of this invention.
[Description of Notations]
100 An intensity control device of a liquid crystal display
1 Liquid crystal panel
2 Back light
3 Luminance sensor
4 Temperature sensor
5 Manual operation button
6 Electric power switch
7 Drive control circuit

[Translation done.]

DRAWINGS

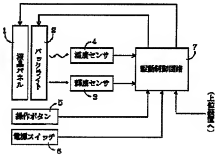
[Drawing 6]

(図6)



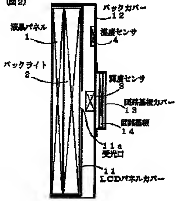
[Drawing 1]

(図1)



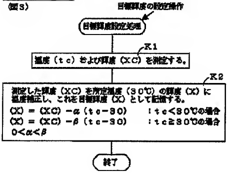
[Drawing 2]

(図2)

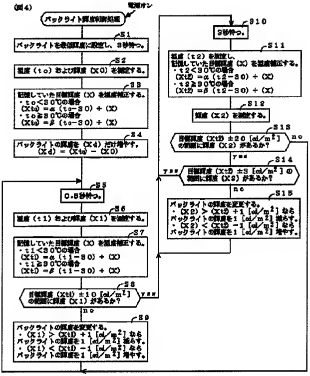


[Drawing 3]

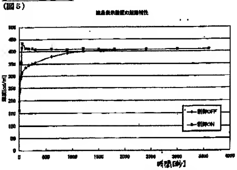
(図3)



[Drawing 4]



[Drawing 5]



[Translation done.]